Specification

Electric vehicle

Technical field

This invention relates to a type of electric vehicle, especially a mini-type four-wheel electric vehicle.

Background of the Invention

Nowadays, mini electric vehicle is widely used for its feature of easy driving and environmental protection. In many areas, since the aged or the disable are difficult in driving, walking or using public traffic tools, electric vehicle has usually become their first choice. In addition, the electric vehicle can also be used in individual traffic, traffic in industrial & commercial fields as well as sports fields such as the traffic in golf course etc. The structure of current mini electric vehicle normally places the battery under the passenger seat. Since this type of vehicle is driven by the rear wheel, its motor and driving device are also installed under the passenger seat. This caused the heavy rear weight of the vehicle. In some occasions especially climbing mountain or slope, this mini electric vehicle may turnover backward and cause injury to the passenger. In order to avoid this, some electric vehicle has to install anti-turnover wheel at the rear. This caused cost increase and complex structure.

Furthermore, since the weight distribution is seriously not balanced, and the handlebar is light, the steering balance is not easy to control. Therefore, the steering and driving performance for current electric vehicle are not satisfied. If the suspension device is used, since the front weight is light, spring force is smaller, the damping of the suspension device is not obvious.

Someone had ever put the battery on the steering shaft to increase the front weight and reach the balance for the front and rear. However, since the load on the steering shaft is increased, the steering is difficult and the center

of gravity is raised while the safety is reduced. Hence, the effect is also not good.

Summary of the Invention

The purpose of this invention is to provide an electric vehicle with battery placed at the front so as to reach the balance of weight distribution and improve the safety and driving performance.

The other purpose of this invention is to provide an electric vehicle with good damping performance and improve the driving comfort.

The third purpose of this invention is to provide an electric vehicle with good steering performance and improve the control of steering, flexibility and smoothness.

The electric vehicle is limited by storage and transportation space. While the battery is placed at the front, it is required not only not to increase the length and weight of the vehicle, but also avoid occupying the space where the driver puts his feet. Hence, the structure of the frame and front wheel suspension device shall be improved at the same time. The idea of this invention is: the front end of the frame is designed as a forward protruding casing for placing the battery while the suspension device is designed as front convex & rear concave shape covered on the frame casing. In this way, the length of the electric vehicle is not increased without any additional parts increased. The space at the front is also fully used since the battery is placed at the front.

The electric vehicle invented includes: frame, seat, two front wheels, two rear wheels, driving device, battery, steering system and front wheel suspension device. The middle & rear part of the frame, seat, rear wheel and the driving device are the same as conventional ones. Its detailed description is omitted here.

The improvement of the invention is: The middle position of the front end of the frame protrudes forward a casing, on which the battery is placed.

The front wheel suspension device appears "front convex & rear concave" shape covering the front end of that casing. Pivot joint exists at the middle of the front end of the casing; two front wheels are installed on the front wheel suspension device. The rear edge line of the two front wheels is located at the rear of the battery front edge;

The steering system is connected to the front end of the frame and interlocks with the front wheel.

The middle of the front end of the casing is provided with two projecting upper/lower connection parts, on which two pairs of upper/lower pivot joints with reverse setting are set.

The front wheel suspension device includes a pair of front upper cantalevers, a pair of front lower cantalevers and vibration damper; the front ends of the front upper & lower cantalevers along the axis of electric vehicle length direction are connected to the pivot joint parts respectively. The rear ends of the cantalevers extend towards the side rear to the side of the frame casing, appearing two similar upper/lower trapezoid; The two left & front cantalevers and the two right & front cantalevers are connected separately with left & right ball head pin at the rear; On the left & right head pins are left & right axles which are used to fix the left & right front wheels; The two dampers are set near the rear end of the cantalever, with one end thereof connected to the frame while the other end thereof connected to the cantilever.

The steering system consists of left & right lateral bars, steering shaft and steering handle; the steering shaft can be set at the front end of the frame rotationally and interlocks with above axles via lateral bars.

In order to improve the firmness of suspension device, two pairs of upper/lower rear cantalevers are additionally provided on the suspension device, which are basically parallel to the front edge of the frame and form the bottom line of the trapezoid; one end thereof is connected to the pivot joint parts while the other end thereof is fixed near the rear end of the front

cantalever.

Stands for steering shaft installation are set on the upper/lower connection parts, respectively. Ball bearing is installed on the stand for free turning of steering shaft.

The steering shaft has a forward protruding part between the upper & lower stands for turning connection of lateral bars.

The lateral bars are ball head link bars.

The front end of the upper/lower connection part is supported with I steel.

The casing has downward concave cavity for placing battery.

This invention adopts the abovementioned improved structure of front frame and suspension device. The battery is moved to the front on the premise of not increasing electric vehicle length. Thus, it realized the balance of front/rear weight distribution. Since the center of gravity of the electric vehicle is at the middle, the driving stability has been improved, especially in climbing slope while it won't tilt backward even if no anti-tilting wheels are installed. In addition, the installation position of the battery is comparatively lower, which makes the center of gravity of the vehicle lower so that the safety driving can be realized.

Again, after increasing the weight of the front part of the electric vehicle, the front wheel suspension device bears more force. This can give full play to its damping function and improve the driving comfort. Furthermore, after the weight of the front part increases, the friction of front/rear wheels is balanced, especially in turning while the friction of the front wheel increases. In this way, the steering and control performance of the electric vehicle has been improved.

Finally, this invention provides with enough room for placing more batteries and increases the power reserve for the electric vehicle so that the driving distance can be farther.

Description of the figures attached.

Fig. 1 is the structural schematic drawing for an embodiment of this invented electric vehicle.

Fig. 2 is the structural schematic drawing for an embodiment of the frame front of this invented electric vehicle.

Fig. 3 is the structural schematic drawing for an embodiment of frame front, suspension device and part of the steering system of this invented electric vehicle.

Fig. 4 is structural schematic drawing of the Fig. 3 viewed from bottom.

Description of the Embodiment

The following is the detailed description of specific implementation example on this invention via attached figures.

Fig. 1 is a four-wheel mini electric vehicle for one person, comprising a frame 1, a seat 2, two front wheels 3, two rear wheels 4, a driving device 5, battery, a steering system 6 and a front wheel suspension device 7. The middle/rear part of the vehicle has not been reformed. Hence, no description below is for it.

See Fig. 2, the front of the frame 1 is basically a plane frame structure, of which the middle position protruding forward a casing 11; The two concave positions of the casing 11 are used for fixing front wheels. Thus, the front width of the wagon didn't increase. The size of the casing 11 is designed to suit for placing the battery matched with the electric vehicle in a protruding way out of the frame body; Also, a little recess into the frame can be done based on the size of the battery; The casing can be in one plane with the frame, can also be made into a battery concave 13 to lower the center of gravity of the electric vehicle and make the height of the battery protruding out of the frame less. When the driver is very tall, the two sides of the battery can be used for the driver to place his feet.

In order to improve the strength of the front of the casing 11, two beams

can be set at the front; If the material's strength is enough, one beam can also be accepted; At the middle of the beam are two upper/lower connection parts 12 for connecting cantalever and steering shaft. The two connection parts 12 protrude forward from casing 11, which are fixed to each other with I steel 14 at the front end; At the upper/lower connection parts 12 are two pairs of front/rear pivot joints 121,122,123,124,121', 122', 123', 124' with reverse setting for pivot-joining the cantilever, respectively. Also on the upper/lower connection parts 12, steering shaft stand 64 and 65 are set with steering bearing installed for free and smooth rotation of steering shaft 63.

As can be seen from Fig.3, the front wheel suspension device 7 consists of a pair of front upper cantalevers 71,72, a pair of front /lower cantalevers 73,74, a vibration damper 79 at both right and left; The front ends of the upper/lower cantalevers 71,72,73,74 are connected to the pivot joints 121, 122, 123, 124 along the axis of the electric vehicle length direction. The rear end of cantalevers extend towards their side rear to the side of the frame casing; The left front cantalevers 71,73 and right front cantalevers 72,74 at the rear end are connected to left/right ball head pins 75,76 respectively; On the left/right ball head pins 75,76 are left /right axles 77,78 for fixing left/right front wheel 3; Vibration damper 79 is set near the rear end of the cantalever, with one end thereof connected to a beam 111 of the frame 11 while the other end thereof connected to the lower cantalever near the rear end of the lower cantalever; The way of connection is conventional way for the vibration damper.

In order to improve the firmness of the suspension device, a pair of the rear & upper cantalevers 71', 72' and a pair of the rear & lower cantalever s73', 74' are set basically parallel to front edge of casing 11; one ends of the rear cantalevers are connected to pivot joint 121', 122', 123', 124', respectively, while the other ends thereof are fixed near the rear end of the front cantalevers 71,72,73,74. Thus, the front and rear cantalevers have formed two upper/ lower triangle or trapezoid structure covering the front end

of the casing 11; The bevel edge angle of the triangle or trapezoid can be determined based on the size of the electric vehicle. The better angle ranges at 40° -50° . With this structure, on the premise of not increasing the length of the electric vehicle, the room for battery has been sufficient. The front wheel 3 fixed on axle 77 and 78 lies in the concave position of the side of the casing 11. Hence, the width of the front part didn't increase. In addition, the rear edge of the two front wheels 3 locates at the rear of the front edge of the battery.

Battery is placed on the frame 11. When the electric vehicle is driven on the way, bumping is transferred to the axle via the front wheels and then, transferred to cantalevers via ball head pins. After damping by the vibration damper 79 connected to the cantalever, as a result of the front weight increase of the electric vehicle, the force transferred to the frame won't cause great vibration for the front frame. Thus, the damping effect of the suspension device has been improved.

See Fig.4. The steering system 6 consists of left/right lateral bars 61, 62, steering shaft 63 and steering handle 66. Lateral bars 61, 62 are ball head link bars, with one ends connected on ball head pin 75,76 rotationally while the other ends connected on steering shaft 63 rotationally. A forward protruding part 631 of steering shaft 63 is set between installation stand 64 and 65, on which left/right lateral bars 61, 62, are co-axially connected. Thus, when the steering shaft turns, the lateral bar drives the ball head pin to turn so as to realize interlock between the axle 77, 78 and the steering shaft 63. Since this steering system has support from ball bearing, its turning is smooth. The front wheel's turning is driven via lateral bars. The structure is simple and the turning is free. The trapezoid bevel edge of the suspension device makes the turning range of the front wheel broader.